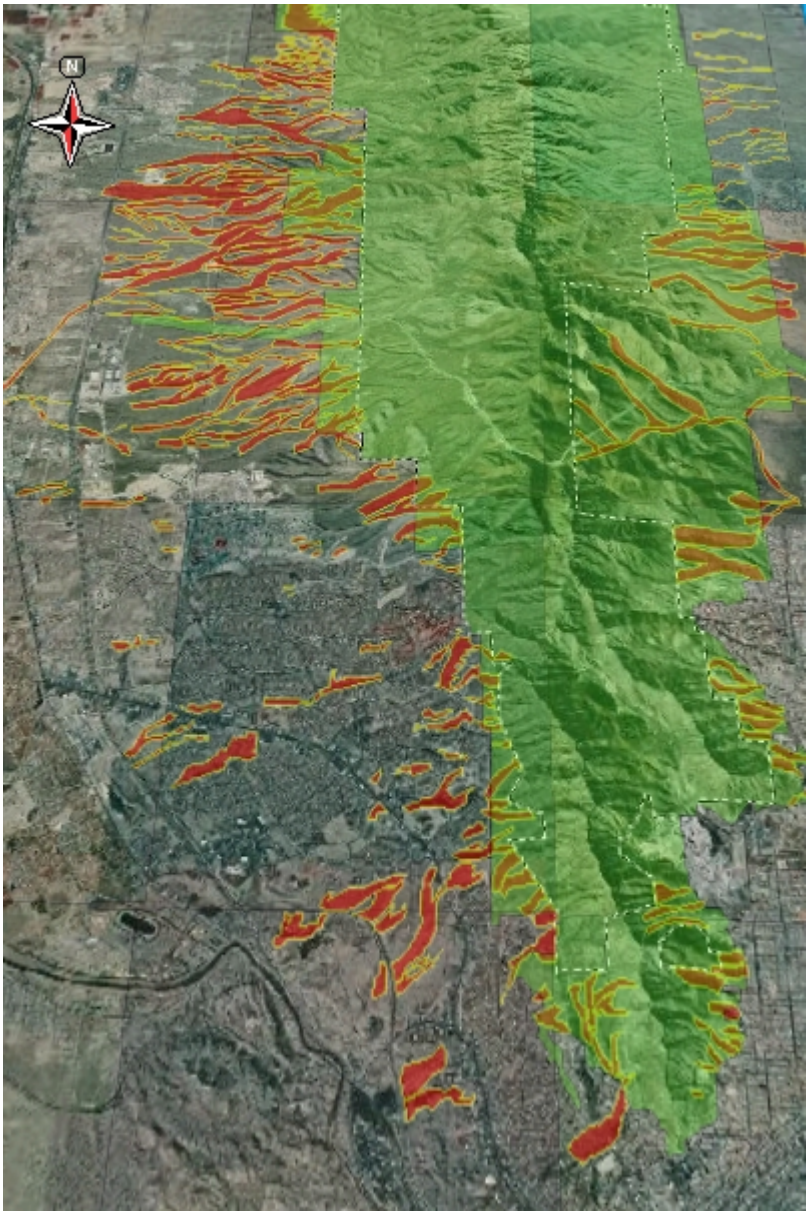
DRAFT

# Arroyo Inventory




City of El Paso
Development Services Department
Planning Division
Dec 2005

## Introduction

This report summarizes the results of the arroyo inventory the Planning Division undertook in the Summer of 2005 at the direction of City Council. It represents a snapshot of the situation at that particular point in time. It is a planning document and, as such, is intended to serve as a guide to decision making. It has no legal power separate from that which may be given by City Council.

The problem of defining arroyos arose when the City considered regulating development in them. Although the term has a commonly accepted meaning of washes or canyons formed by seasonal rainwater, such a broad definition could be applied to innumerable small erosional features throughout the City. After much discussion among stakeholder groups, the Council decided that mapping a universe of individual features and designating selected elements was the best course. Planning staff accepted the assignment.

Arroyos have certain characteristics in common which were the foundation of the inventory. The path left by an ephemeral stream in the desert is usually identifiable by scouring of the topsoil and/or increased amounts of vegetation, forming a linear feature. In addition, the stream route follows the lowest path within the watershed area.

These arroyo characteristics can be seen in the field, but they can also be studied remotely. The necessary information can be found in aerial photographs and in elevation surveys. Depending on the source of the data, the accuracy and precision of information sets an automatic limit on the number of features that could be identified. Flood maps designated only those areas that would be subject to inundation during rainfall events; this was deemed to few. Staff tested various computer programs that could be used to automatically classify features like arroyos; these experiments yielded too many features. The issue of finding a rim for each arroyo was the most problematic. Finally, staff decided to study the available data by hand and have knowledgeable planners judge a reasonable boundary for the features.

The section below describes the procedure that was followed to develop the basic arroyo inventory. Not described are the many additional analyses that were performed on a small subset of the inventory to test methods of ranking arroyos as to their value for preservation.

# Methodology

## *Data Sources*

Two types of data, as mentioned above, were used to identify the boundaries of arroyo candidates. Digital aerial photographs were available on the City's data network. These photos were three color georectified tiles with a one foot pixel resolution, taken by a TxDot contractor in 2003. TxDot was also the source for the elevation data. They provided Triangular Irregular Network (TIN) files with a ten meter horizontal and one meter vertical resolution obtained by radar.

After the arroyos were identified, other City data sets provided further information such as ownership, zoning and recreational use. The Texas Natural Resources Information Services web site supplied valuable lower resolution data that served as framework for organizing the project. Digital FEMA flood insurance rate maps were obtained from the internet and the paper versions were borrowed from the engineering department.

## *Tools*

ArcGIS by ESRI was the primary software tool for the project. The software provides a platform for viewing and analyzing both images (rasters) and features (vectors) on the computer. Three dimensional analysis extensions to ArcGIS were purchased to enable visualization of the topography of the Franklin Mountains and bajadas.

ENVI software by RSI Inc. was used for some experiments in remote classification of habitat and vegetation. Unfortunately, the three color aerial photos were not suitable for differentiating between vegetation communities and multi-spectral data available from UTEP and the internet did not have sufficient resolution to single out the smaller arroyos.

A Trimble GeoXT handheld computer GPS unit proved very useful in field work. Files created on ArcGIS could be transferred to the unit and studied on location in arroyos. Again, this work is not described in the present report.

## *Process*

The actual process of drawing the boundaries of the arroyo candidates was as follow:

1. Review the aerial photomosaic of all land within the City limits surrounding the Franklin Mountains. Review the hydrology layers held in the Information Services database. Review the FEMA flood zone A regions and the flow path designations.

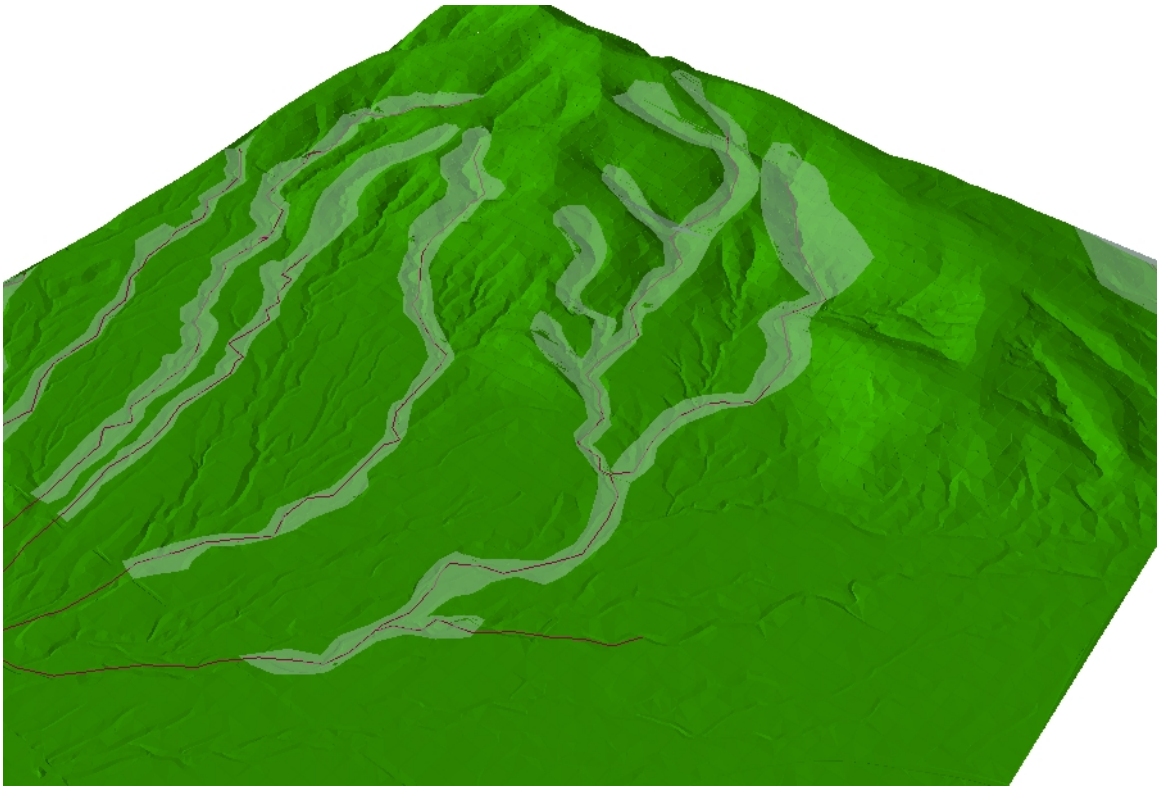
2. Create a GIS line layer of stream beds by tracing the evidence of natural flow seen on the aerial photos. Start with the other maps as a guide and include any streams shown on them. Then add smaller streams that feed into them. [This

resulted in a database of over 400 lines. It should be noted that in the next step some lines were consolidated with others so that there were only 285 arroyos.]

3. Organized the line into systems that flow into a common channel. At each junction start a new line to separate the streams by stream order.

4. Create the three dimensional rendering of the area covered by the stream flow lines. Draw rim boundary polygons outlining the apparent high points surrounding the flowlines. In steep areas this can result in ridges serving as the rim for two adjacent arroyos. In flat lower areas this is often quite narrow. Close the boundary whenever the stream joins with another flowline.

5. Number each boundary polygon and assign a names to each arroyo if possible. Use GIS to calculate size and other characteristics of each arroyo.



# Findings

The tables below summarize the information developed for the inventory. The complete tables in Appendix B and C provide information for each individual arroyo shown on the maps. Appendix D has a locator map.

## *Number and area*

Two hundred eighty five arroyos were inventoried for a total area of 8910 acres (nearly 14 square miles). See Figure 1. The total length of ephemeral stream beds counted was approximately 175 miles.

## *Public vs Private Ownership*

Of the arroyos in the inventory, slightly more area is under private ownership than is owned by the City of El Paso. However if State land (GLO) and Federal land in Castner Range is included private land is less than half the total area. See Figure 2.

| Total Area | City of El Paso | Federal | State of Texas | Private Owners |
|---|---|---|---|---|
| 8910 | 3704 | 1074 | 271 | 3861 |
| 100% | 41.5 % | 12.1% | 3.0% | 43.4% |

## *Zoning, Mountain Development Area*

All land within the City limits is within some zoning district. Land in Castner Range is not zoned. Just over 50% of the land in the arroyo inventory is zoned R-3. Another 28 percent is within the Planned Mountain Development area. See Figure 3.

| Zoning District | Total Acres | Percent |
|---|---|---|
| A-2 | 121.79 | 1.55% |
| A-3 | 7.58 | 0.10% |
| A-O | 28.50 | 0.36% |
| C-1 | 53.06 | 0.68% |
| C-2 | 6.46 | 0.08% |
| C-3 | 87.16 | 1.11% |
| C-4 | 158.11 | 2.02% |
| M-1 | 154.26 | 1.97% |
| M-2 | 0.21 | 0.00% |
| M-3 | 147.13 | 1.88% |
| P-C | 0.92 | 0.01% |
| P-R 1 | 123.27 | 1.57% |
| P-R 2 | 113.04 | 1.44% |
| PMD | 2193.92 | 27.99% |
| R-2 | 12.07 | 0.15% |
| R-3 | 3978.19 | 50.75% |
| R-3A | 368.66 | 4.70% |
| R-4 | 28.55 | 0.36% |
| R-5 | 10.5 | 0.01% |

| | | |
|---|---|---|
| R-F | 245.0 | 3.1% |

Eighty five arroyos have at least some portion covered by an approved subdivision plat, adding up to 590 acres or 6 percent of the total. Some of this land is not slated for development, as it was platted as a park (Arroyo Park) or as common open space for a homeowners association. See Figure 4.

One hundred twenty three arroyos have at least some portion within the mountain development area (MDA.) Total acreage of arroyos in the MDA is 3127. MDA is not the same as PMD zoning; the zoning can be changed by application to City Council, whereas the MDA was designated by metes and bounds in a separate ordinance. The MDA imposes certain standards on subdivision development, including preservation of "watercourses" carrying more than 5 cubic feet per second in a 100 year storm. Flood zones must also be preserved. See Figure 5.

## *State Park and Trails*

Recreational trails crisscross the area below the mountains. These trails are on City or private property. Ninety two of the arroyos in the inventory have trails on some part of them. Many arroyos in the undeveloped areas or very close to the mountain form a direct corridor to the Franklin Mountains State Park. If a direct corridor is defined as an arroyo having no paved road or developed area between it and the park boundary, one hundred eight arroyos meet this criterion. Some of these connect to another arroyo before reaching the park, but no man made obstruction is present. See Figure 6

## *Appendix A*

### *Figures:*

1. **Boundaries**
2. **Ownership**
3. **Zoning**
4. **Subdivisions**
5. **Mountain Development Area**
6. **Park Corridor and Trails**

***Figure 1***

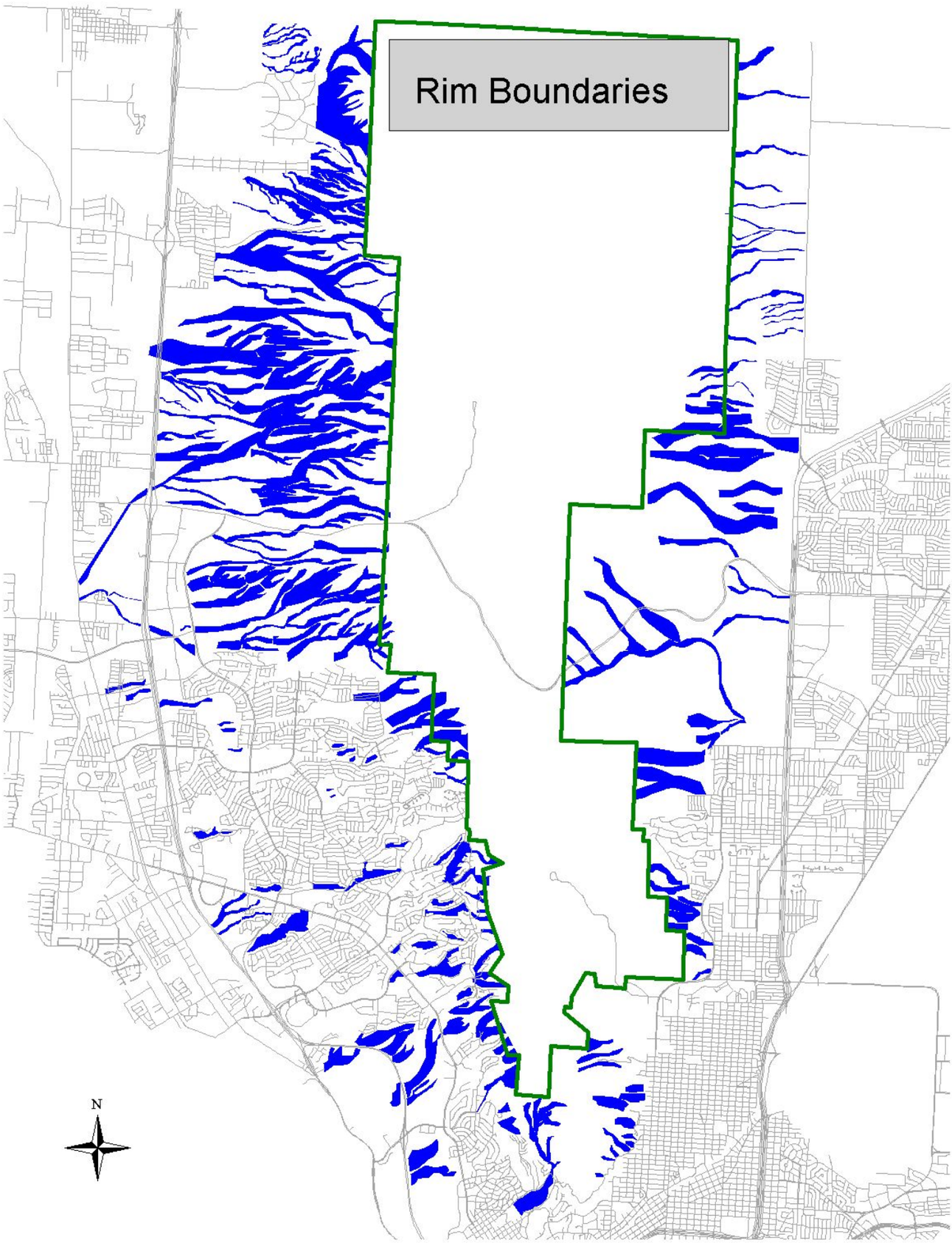


**Figure 2**

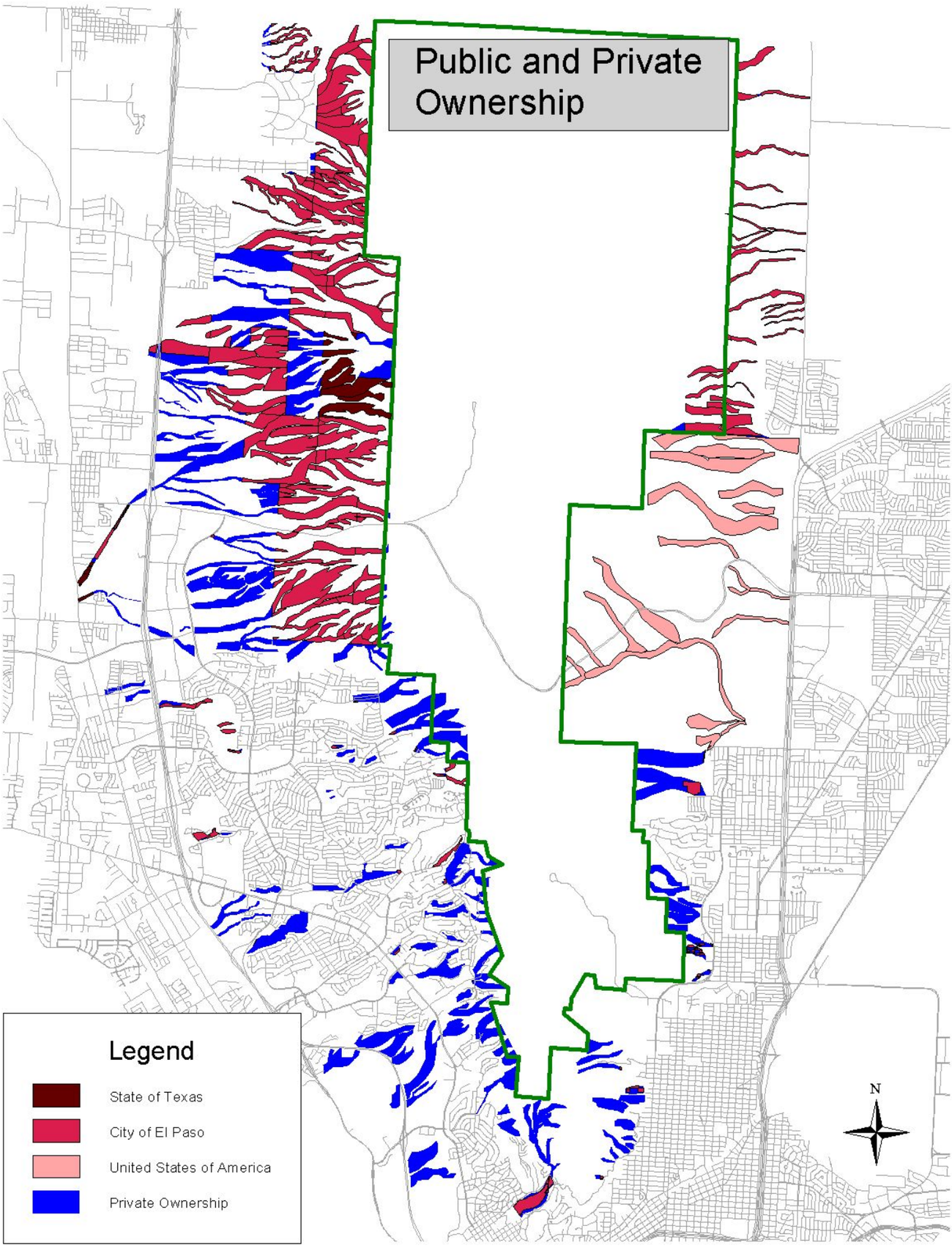


**Figure 3**

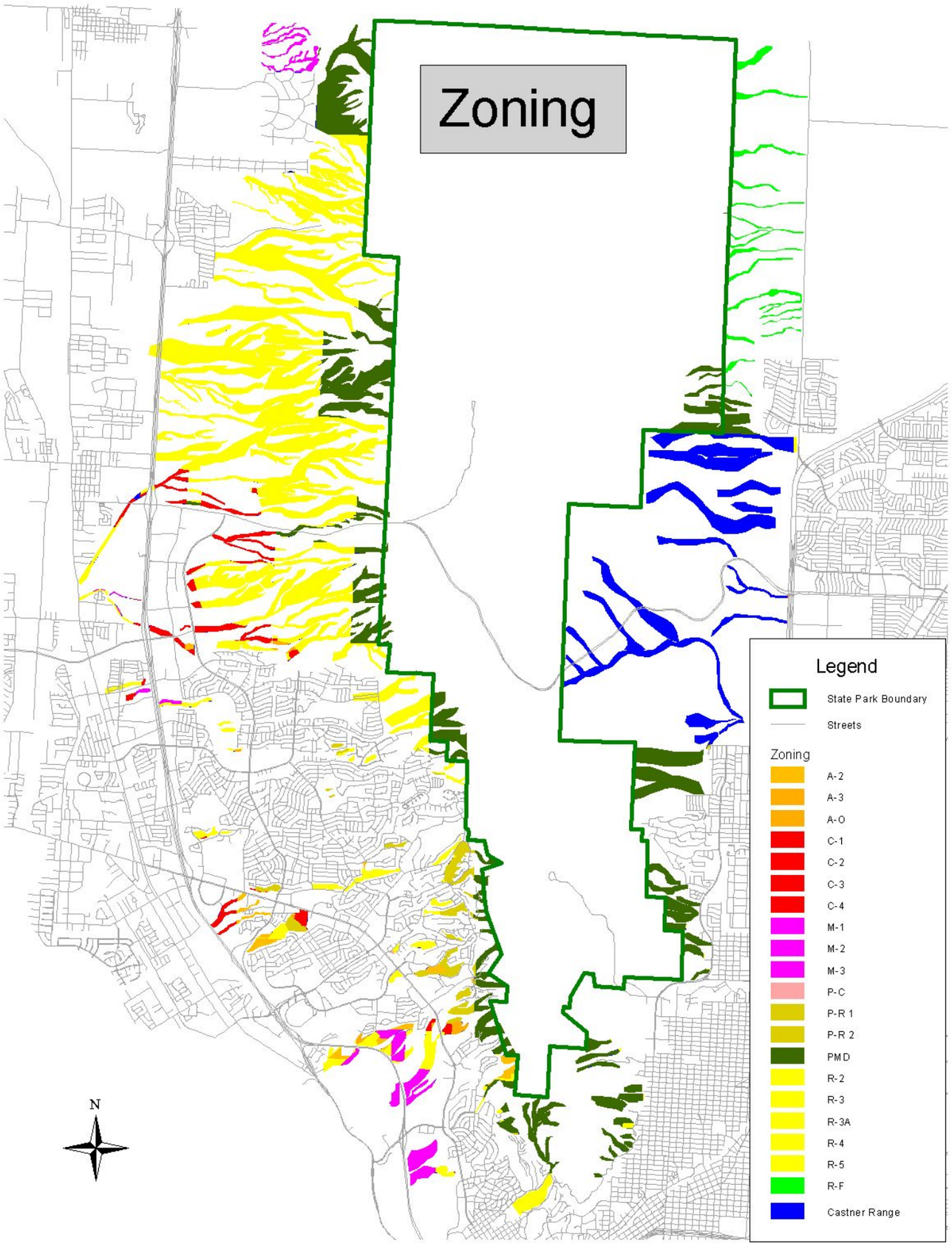


**Figure 4**

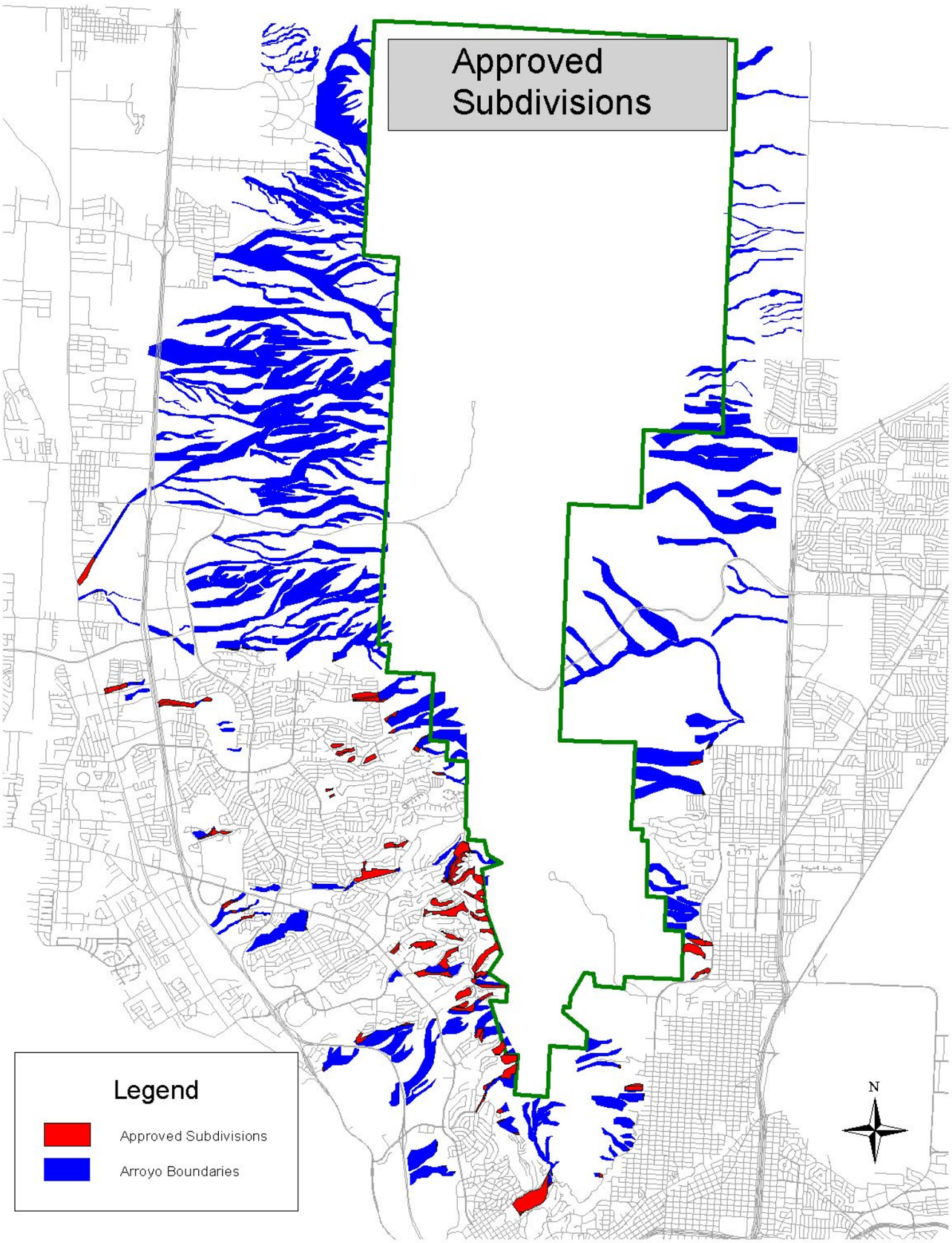


**Figure 5**

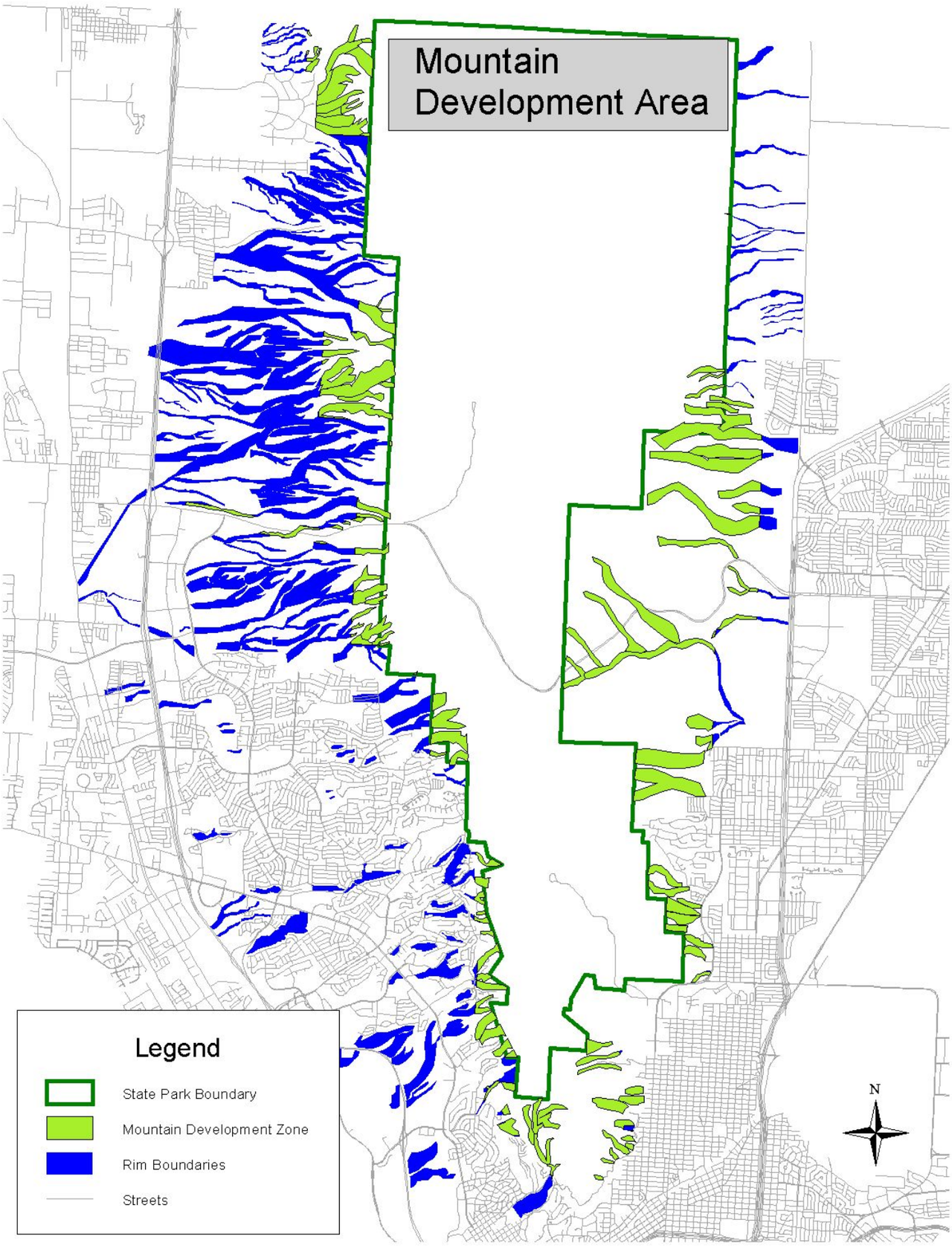
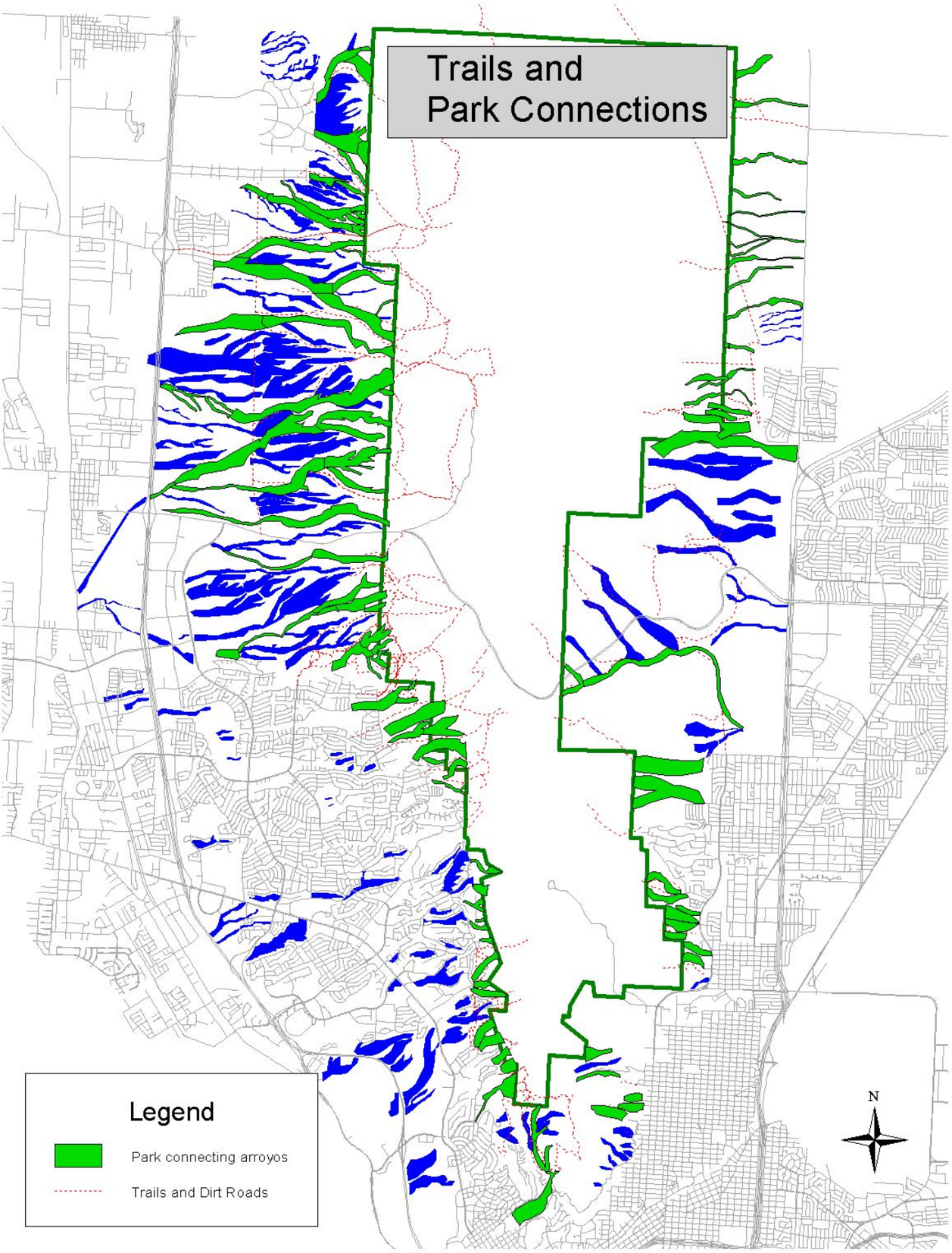


**Figure 6**



# Apendix B

# Arroyo Characteristics

# Appendix C

# Arroyo Zoning Table

# Appendix D

## Locator Map